

THE MINERAL INDUSTRY OF

ARMENIA

By Richard M. Levine

Armenia's mineral industry in recent years was primarily involved in mining nonferrous metals and industrial minerals. Armenia has large molybdenum reserves and had been mining one-third of the former Soviet Union's (FSU) output of molybdenum; the molybdenum was associated with copper. Armenia also mined copper and copper-zinc deposits and has a native gold mining industry. Significant byproduct constituents in the country's nonferrous ores include barite, gold, lead, rhenium, selenium, silver, tellurium, and zinc.

Armenia has a large industrial minerals industry and was the largest producer of perlite in the FSU. It produced a number of other industrial minerals, including clays, diatomite, dimension stone, limestone, salt, and semiprecious stones, and had a diamond cutting industry. However, Armenia had practically no mineral fuel production in 1997 and was dependent on imported mineral fuels.

Regarding mineral resources, in Abovian and Hrazdan there are two iron ore deposits considered to have industrial potential. These deposits are estimated to contain 400 million metric tons (Mt) and 150 Mt, of ore, respectively. The average iron content of ore in the Abovian deposit is 28% and in the Hrazdan deposit 32%. The iron ores of these deposits, in addition to their main component iron, contain rare earth elements of the cerium and yttrium group, as well as dispersed germanium, gallium, thallium, niobium, and tantalum. The Hrazdan deposit also contains zirconium.

Armenia's most significant mineral resource base is of copper-molybdenum ores. The Kadzharan deposit contains more than 90% of the country's molybdenum reserves and is considered a potential source of molybdenum for the next 100 years. The molybdenum content of the ore at Kadzharan varies from 0.001% to 0.1%. Other ore constituents include bismuth, germanium, gold, rhenium, selenium, silver, and tellurium. The deposit is mined by the Zangezur mining and beneficiation enterprise, which is the largest enterprise in the mining industry.

Lead and zinc ores are the second most common nonferrous ores and are located in lead-zinc, copper-zinc, and complex gold-polymetallic ore deposits. The lead content of the ores range from 1.5% to 3%, the zinc content from 2% to 6%, and the copper content from 0.5% to 1%. These ores also contain bismuth, cadmium, indium, and selenium as well as precious metals. Along with byproduct gold, there are native gold deposits in Zod, Megradzor, and Terterasar.

Regarding industrial minerals, salt deposits having estimated reserves of between 150 to 200 billion metric tons have been found near Yerevan. Armenia's volcanic rocks are useful building material. The white, pink, orange, and black tuff are light, durable, and easily processed. They serve as a main

construction and decorative material. Estimated reserves of tuff in Armenia is 3 billion cubic meters. The country has abundant deposits of marble, granite, high quality travertine, and limestone and small deposits of gypsum.

There are also deposits of natural mineral sorbents such as bentonite. The Sarigyugh deposit contains a high quality alkaline bentonite resource base. There are three identified deposits of perlite in Armenia with two deposits (Aragats and Jzaber) under development. The only identified zeolite deposit is the Noyemberian and has estimated resources of 150 to 170 Mt. The resource base of diatomite consists of five deposits. There are reportedly considerable undiscovered diatomite resources.

Armenia is rich in semiprecious and ornamental stones such as agates, amethyst, jasper, obsidian, onyx, and turquoise. Obsidian is found in northern Armenia, particularly in the Hrazdan region. Armenia produces jewelry and decorative art works made from these stones (Armenian Embassy in the United States, 1998, Natural resources, accessed August 4, 1998 at URL <http://www.armeniaemb.org/investment/natural.htm>).

Armenia has no fossil fuel production with the exception of a small amount of coal, although it does contain hydroelectric and nuclear electric generating capacity. Its only sources of fuel since blockades by Azerbaijan and Turkey were imposed in 1991 and 1993, respectively, are of gas shipments from Turkmenistan through a pipeline from Georgia, along with small shipments of petroleum refinery products from Georgia's Batumi refinery (United States Department of Energy, Energy Information Administration, December 1996, Armenia, accessed August 5, 1998 at URL <http://www.eia.doe.gov/emeu/cabs/armenis.html>).

Since the imposition of the blockades, insuring an adequate energy supply has been a critical issue for the country. In 1997, the country generated 6.0211 billion kilowatt-hours (kWh) of electricity, which was 3.1% less than in 1996. In 1997 compared with 1996, generation at thermal power plants rose 30.8%, while at hydroelectric plants it fell by 11.7% and at the Armenian Nuclear Power Plant it fell by 31.1%. In 1997, the nuclear plant generated 1.6002 billion kWh (26.6% of total electricity generation), thermal power plants generated 3.0316 billion kWh (50.3%) and hydroelectric plants generated 1.3893 billion kWh (23.1%). In 1997, Armenia generated 660,600 gigacalories of heat energy, which was 5.7% more than in 1996 (Interfax Statistical Report, 1998b).

In June, the Government of Armenia decided to allow previously classified information about mineral reserves to be published. All information about gold, mercury, silver, and uranium reserves had been classified secret as of February 17, 1992, as was information about reserves of thorium, molybdenum, zirconium, and zinc. The Government will allow information to

be published on the size of ore bodies and their average metal content, on the production of mines and processing plants, and on the content of gold in ores and concentrates. The release of this information is intended to facilitate foreign investment in mineral projects (Interfax Mining and Metals Report, 1997b).

In August 1998, the State Commission for Mineral Reserves announced that reserve data, which had all been based on the Soviet reserve classification system, would be reevaluated based on a new classification system that would, while still preserving the Soviet reserve system categories, add a number of additional elements to the system, including elements to account for the value and size of reserves and a coefficient to account for the value per ton of a resource versus its cost to develop (Interfax Mining and Metals Report, 1998a).

Regarding newly discovered reserves, in 1997, the Armenian State Commission for Mineral Reserves confirmed 17 metric tons (t) of gold reserves at the Azatek lode deposit 140 kilometers east of Yerevan. The lode reportedly also contains 400 t of silver, 13,500 t of copper, and small quantities of antimony, lead, and zinc. Azatek was the first gold field to have its reserves confirmed by the State Commission that was established in 1993, although there are reportedly larger gold lodes in the country. The State Commission had confirmed reserves at 28 new industrial minerals deposits and listed additional reserves at the Zod gold lode deposit (Interfax Mining and Metals Report, 1998b).

Since the 1994 cease-fire with Azerbaijan, Armenia's gross domestic product (GDP) began to increase. In 1997, GDP increased by 3.1% compared with 1996, and industrial output increased by 0.9% (Interfax Statistical Report, 1998a).

Of the country's 440 industrial enterprises, 115 registered increased outputs compared with those of 1996. Among individual enterprises with the biggest increases in output were the Ararat cement works (13.2%), the Zangezur copper and molybdenum plant (9%), and the Sapfir (Sapphire) plant producing industrial stones (26.8%). Compared with those of 1996, at the Shogakhn diamond-cutting plant output fell by 24.9%, at the Kanaker aluminum fabrication plant by 47.8%, at the Yerevan Jewelry Plant by 62.2%, and at the Armzoloto gold mining enterprise by 76% (Interfax Statistical Report, 1998a; Interfax Mining and Metals Report, 1998j).

In 1997, output from Armenia's mining and metals industry decreased by 21.4% compared with that of 1996. Output for molybdenum concentrate with an estimated metal content of 51%, however, rose to 3,273 t in 1997 from 3,116 t in 1996. Nearly all the molybdenum concentrate was produced at the Zangezur copper-molybdenum plant, which mines the Kadzharan deposit, in the Kapan district in southern Armenia.

At the Zangezur copper-molybdenum plant output of copper in concentrate increased to 5,288 t from 4,486 t in 1996, but copper production from the nearby Kapan Mine fell by nearly one-half to 1,470 t from 2,465 t in 1996. In 1997, the Kapan Mine increased production of zinc in concentrate to 610 t compared with 557 t in 1996 (Interfax Mining and Metals Report, 1998e).

Plans called for privatizing all major mining and metallurgical enterprises between 1998 and 2000. These plans are part of the third phase of the privatization program. Enterprises to be privatized include the Zangezur copper-molybdenum mining and

beneficiation complex, the Agarak copper-molybdenum mining and beneficiation complex, the Kapan copper-zinc mining complex, the Armzoloto gold mining complex, the Kanaker aluminum fabrication plant, the Akhtala copper mining and beneficiation complex, and the Shogakhn diamond-cutting enterprise. Although privatization in the first and second phases was based on voucher certificates, privatization in the third phase is to be for money only (Interfax Mining and Metals Report, 1998f).

In the nonferrous metals sector, an Armenian-Iranian joint venture, Ar-Al, was formed to produce aluminum sections and consumer goods. The venture was to be owned by the Kanaker aluminum fabrication plant in Yerevan (17%), by the Armenian Government (49%), and by Faragam of Iran (34%). The Ar-Al joint venture was scheduled to go into operation in January 1998. In its first year, it would require investment in cold-and hot-rolled presses. The Kanaker plant had made some of its own capacity available, and the Iranian side was to upgrade technology and production processes. Ar-Al anticipated manufacturing aluminum sections, food containers for passenger aircraft, radiators, and solar-powered water heaters. According to Armenian Government statistics, the Kanaker plant produced 112 t of aluminum foil and 125 t of semifabricated aluminum products in the first 9 months of 1997 (Interfax Mining and Metals Report, 1998d).

The Zangezur copper-molybdenum mining and beneficiation enterprise had been developing the Kadzharan deposit by open-pit mining since 1958; output peaked at 9.2 million metric tons per year (Mt/yr) of ore in the 1980's. Production data on copper and molybdenum output in Armenia was classified as secret during the Soviet period and by Armenia following independence; past and present production data are only now becoming available. According to recent reporting, Zangezur produced 7,800 t of molybdenum concentrate with a metal content of about 50% and 6,100 t of copper in copper concentrate in 1990 (Interfax Mining and Metals Report, 1997e).

In 1991, the Zangezur enterprise began to suffer severe economic problems as the Soviet Union began disintegrating. Only in 1995 did production begin to revive as the Government was able to invest in the enterprise. In 1995 and 1996, Zangezur was reportedly working at about 50% of its capacity, producing 3,116 t of molybdenum concentrate and 4,486 t of copper in concentrate from 3,115 Mt of ore in 1996 (Interfax Mining and Metals Report, 1997e).

Although Zangezur was producing almost the entire molybdenum output for the country, it produced less than one-half of the country's total copper in concentrate production of 9,100 t in 1996 (Karmanov and Kozyrev, 1998). Plans for 1997 called for Zangezur to produce 3,400 t of molybdenum concentrate and 5,000 t of copper in a 20% concentrate. At present, about 20% of the molybdenum extracted in ore and 30% of the copper end up in waste dumps. The molybdenum concentrate from Zangezur had been processed in Russia at the Pobedit metallurgic plant in North Ossetiya and the Skopino plant in the Chelyabinsk region and also in Uzbekistan at the Chirchik hard metals plant. During the Soviet period, the copper concentrate was processed in Armenia at the Alaverdi plant which was closed because of environmental concerns.

The copper concentrate was bought mainly by Iran and also by the Manes-Vallex joint venture, which is based in northern Armenia; the joint venture is 53% owned by the Liechtenstein-registered Vallex Corp. The molybdenum concentrate is exported by a Dutch firm, the name of which Armenian officials would not disclose. The molybdenum concentrate is transported by road to Yerevan, then by rail to the Georgian port of Poti on the Black Sea, and then shipped to Rotterdam. Armenia planned to construct its own facility to process molybdenum and began negotiations with foreign firms to design a plant to produce up to 8,000 metric tons per year (t/yr) of molybdenum trioxide (Interfax Mining and Metals Report, 1997e).

Since April, the Agarak copper-molybdenum mining and beneficiation complex, also in southern Armenia, has been virtually idle since April owing to a lack of working capital. The complex was negotiating a joint venture with the British company Derek Raphael that would expand Agarak's resource base by developing the Megran deposit close to the border with Iran. In 1996, Agarak mined 866,000 t of ore to produce 2,130 t of copper concentrate and 117 t of molybdenum concentrate (Interfax Mining and Metals Report, 1997a).

In the northern part of the country, Nove Mtebi, a Georgian company, was planning to finance the renovation of the Armenian state-owned Akhtala mining and beneficiation complex, which produced from 10,000 to 12,000 t of copper concentrate in the 1980's. The complex would restart operations at the Akhtala polymetallic and the Shamlug copper deposits. These had been worked by underground mines. Akhtala had been part of the Alaverdi mining and metallurgical complex, but mining ceased with the closure of Alaverdi in 1989. Plans were to increase production to above former levels. The complex would then supply the Madneuli metallurgical plant in Georgia with copper, lead, and zinc concentrates. Ore from Akhtala reportedly contains significant byproduct gold and silver (Interfax Mining and Metals Report, 1997i).

In October, Armzoloto, the country's chief gold producer, announced that in accordance with the Soviet reserve classification system, the country has about 200 t of proven gold reserves, which, under the Soviet system, were deemed ready for development. The Zod gold lode, close to the border with Azerbaijan, was said to contain 160 t of reserves, and the nearby Megradzor gold lode, 20 t (Interfax Mining and Metals Report, 1997d).

In 1996, Armzoloto produced 244 kilograms (kg) of gold, and plans called for production to increase to 850 kg in 1997, 1,250 kg in 1998, 1,600 kg in 1999, and 2,000 kg in 2000. Armenia had produced 31.4 t since its gold industry was established in 1976; of that, 20 t was produced from ore mined in Armenia, and the remaining amount, from ore shipped in from Georgia, Kazakstan, and Uzbekistan. Gold production peaked at about 2.5 t/yr in the mid-1980's (Interfax Mining and Metals Report, 1997d).

In the gold production sector, Armenia signed an agreement with First Dynasty Mines Ltd., a U.S.-Canadian firm, to develop mines at the Zod and the Megradzor lodes in northeastern Armenia; gold production eventually should increase to about 13 t/yr. The agreement, signed on October 1, was preliminary and had to be appraised by four Armenian ministries and win the

approval of the full Government. It was hoped that a finalized 20-year agreement would be signed by the end of the year (Interfax Mining and Metals Report, 1997f).

First Dynasty completed the appraisal of the two Armenian gold deposits and drafted a preliminary feasibility study for their development. First Dynasty reportedly assessed Zod to contain 10.7 Mt of minable ore grading 6 grams per ton (g/t) of gold. A mill at the site would have the capacity to process initially 1 Mt/yr of ore increasing to 2.5 Mt/yr. Megradzor was assessed to hold 815,000 t of ore grading 12.25 g/t of gold (Interfax Mining and Metals Report, 1998h).

First Dynasty engineers expected to begin development in August 1998. It planned to construct the new mill within 1 year. Until the mill is completed, ore will be milled at the Ararat gold recovery plant 120 km from the deposit. The agreement also called for the renovation of the existing mill at the Ararat gold recovery plant. First Dynasty envisaged producing up to 6 t/yr of gold by the end of 1999, of which it would own a 50% share of the output (Interfax Mining and Metals Report, 1998c).

In December, Armenia and First Dynasty postponed signing the agreement on the joint development of the Zod and the Megradzor gold lode deposits because a number of points within the agreement had to be reworked. The Armenian Ministry of Environmental Protection objected to the construction of the mill at Zod because it was too close to the Sevan National Park (Interfax Mining and Metals Report, 1997c).

In June 1998, the Government of Armenia formally approved the agreement with First Dynasty for development of the Zod and the Megradzor deposits with the name of the new joint venture the Ararat Gold Recovery Company (First Dynasty Mines Ltd., June 24, 1998, Company press release, accessed June 25, 1998, on the World Wide Web at URL http://biz.yahoo.com/prnews/980624/first_dyna_1.html).

Armzoloto had been developing the Zod field since 1976. Another firm from the United States, RV Investment Group Services LLS, had signed an agreement to develop this field with authorities in Azerbaijan. Azerbaijan is claiming that the majority of this field, which Azerbaijan calls Sutlinskoye, is located in Azerbaijan. RV Investment is claiming that 73% of the field lies on Azerbaijani territory and that this portion contains 80 t of gold. The president of First Dynasty Mines stated that he felt the Azerbaijanis were basing their claim on distorted geographical coordinates (Interfax Mining and Metals Report, 1997f).

Decalite, a U.S. company and a member of Belmont Holding, acquired the Aragats perlite plant, which quarries and mills perlite. The plant, which is 80 km west of Yerevan, can quarry and process up to 60,000 cubic meters per year of perlite. The Aragats deposit reportedly contains an estimated 85 million cubic meters (Mm³) of mineral reserves, of which more than 82% is perlite, 11%, pumice, and 6%, gem-quality obsidian. Armenian geologists stated that the country possesses three perlite deposits, including Aragats, containing 156 Mm³ of perlite (Interfax Mining and Metals Report, 1998g).

In November, the European Union (EU) decided to allocate ECU 978,000 to Armenia during the next 12 months under its Technical Assistance to the Commonwealth of Independent States (TACIS) program for a project to use nonmetallic natural

resources. The project involves using basalt, perlite, and other materials to produce heat, sound, and acid proof materials. The Kamen i Silikat (Stone and Silicate) firm will represent Armenia in the project, which intends to increase output of these products for export by between 30% and 40% (Interfax Mining and Metals Report, 1997g).

At Armenia's state-owned Shogakhn diamond cutting enterprise in Nor-Achin, output was 30% lower in 1997 than that of 1996. Shogakhn, founded in 1981, has the capacity to produce between 100,000 and 120,000 carats per year of gems cut to between 0.01 and 1.5 carats. Starting in January 1998, Shogakhn, which was already purchasing rough diamonds from De Beers, was to become a De Beers sight-holder under an agreement reached with De Beers in November. Shogakhn would become a client of the De Beer's Central Selling Organization (CSO) and attend regular CSO sights on the same terms as other buyers (Interfax Mining and Metals Report, 1997j).

Shogakhn planned to raise purchases of rough diamonds from De Beers to between \$50 million and \$60 million per year. Purchases from De Beers had amounted to about \$40 million during an 18-month period in 1996 and 1997. In 1997, Shogakhn was producing between \$35 million and \$38 million worth of cut stones, mostly for export to Belgium, Cyprus, and Japan. One of Shogakhn's main customers in Belgium was Backes and Strauss, which was also providing Shogakhn with about \$5 million to \$6 million per year in credit to buy rough stones. The Armenians, also were negotiating with Russia in an attempt to resume shipments of Russian stones under tolling agreements stopped in 1996. The Russians and Armenians were discussing trade of about 215,000 carats per year (Interfax Mining and Metals Report, 1997j).

Additionally, in September, the Association of Armenian Diamond Manufacturers drafted a program for the development of the gem industry up to 2001. The program calls for setting up a network of small diamond-cutting plants (Interfax Mining and Metals Report, 1997h). In 1997, the Belgium Arslanian Cutting Works BVBA brought two cutting centers into operation in mid-September. The Armenian Government also was planning to open a diamond-cutting shop in Nagorno Karabakh. Armenia was exporting about \$50 million worth per year of cut diamonds, of which Shogakhn accounted for almost 80% of the sales (Interfax Mining and Metals Report, 1997j).

Armenia is reviving production of nonferrous metals and industrial minerals, with foreign investment playing an important role in both restoring output and creating facilities to produce value added products. Although increasing its production of copper, cut diamonds, and gold would be significant for the Armenian economy, Armenia could become a major regional molybdenum supplier if it reaches its capacity for molybdenum production. Reviving mineral production has progressed despite the great economic hardships Armenia is enduring because of the blockade imposed by Azerbaijan and Turkey. Were Armenia to achieve a resolution acceptable to all parties to the political problems in the region caused by its conflict with Azerbaijan over the status of Nagorno-Karabakh and other issues resulting from that conflict, Armenia potentially could make more rapid progress in developing its mineral industries.

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Major Sources of Information

U.S.-Armenian Business Council

122 C St., NW, Suite 350
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Telephone: (202)393-3745
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Armenian Chamber of Commerce and Industry

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Yerevan Stock Exchange

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Adamand Yerevan Stock and Commodity Exchange

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TABLE 1
ARMENIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity		1993	1994	1995	1996	1997
Bentonite		100	100	110 2/	275 2/	300
Cement		200	200	228 2/	282 2/	300
Copper, concentrate, Cu content	metric tons	500	500	8,080 2/	9,080 2/	9,300
Gold	kilograms	500	500	514 2/	244 2/	850
Limestone		500	100	26 2/	441 2/	500
Molybdenum, concentrate, Mo content	metric tons	500	500	1,500	1,600	1,700
Perlite		10	10	NA	NA	NA
Salt	metric tons	50,000	30,000	32,800 2/	26,400 2/	27,000
Silver	kilograms	NA	NA	184 2/	626 2/	1,000

NA Not available.

1/ Includes data available through December 11, 1998.

2/ Reported figure.